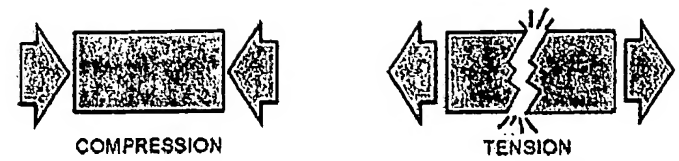
What is Post - Tensioning?

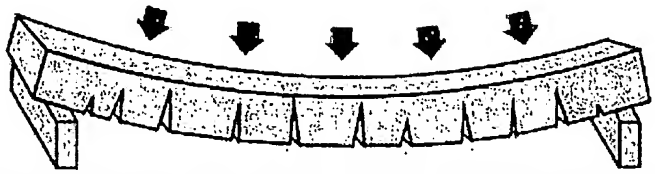
Simply put, Post-Tensioning is a method of reinforcing concrete, masonry, and other structural elements. Post-Tensioning is a method of prestressing. Prestressed concrete or masonry has internal stresses (forces) induced into it during the construction phase for the purpose of counteracting the anticipated external loads that it will encounter during its lifecycle.

There are two methods of prestressing. One is called pre-tensioning. This method consists of stressing the reinforcing inside of large steel buttresses, and then casting the concrete around the reinforcing. This method can only be done at a precast manufacturing facility and requires the completed prestressed concrete members to be trucked out to the job site and then assembled. The other method of prestressing is called post-tensioning. Instead of stressing the reinforcing inside of large steel buttresses at a manufacturing plant, the reinforcing is simply installed on the job site after the contractor forms up the slabs or constructs the walls. The reinforcing steel is housed in a sheathing or duct that prevents the steel from bonding to the concrete so that it can be stressed after the concrete cures (hardens). Using the post-tensioning method of prestressing enables a builder to get all the advantages of prestressed concrete or masonry (described below) while still enabling the freedom to construct the member (slab, wall, column, etc,) on the job site.

WHY DOES CONCRETE AND MASONRY NEED TO BE REINFORCED

Concrete, masonry, and most cement based products are very strong in compression, or, in other words, they have a high capacity to resist compressive forces. Compressive forces can be described as crushing forces. Concrete has a very high compressive strength. It can be anywhere from 2,500 pounds per square inch, in most residential foundations, to 4,000 psi in suspended slabs and walls in buildings, to even higher strengths in bridges. However, concrete is relatively weak in tension, i.e. it doesn't resist tensile forces very well. Tensile forces are the forces that pull an element apart.





Tensile forces pull apart the bottom of this concrete slab when it bends

Conversely, steel is very strong in tension. It has a high capacity for resisting the forces that pull apart or bend it. Therefore, combining reinforcing steel with concrete or masonry results in a product that can resist both compressive forces and tensile forces. Additional, substantial benefits can be obtained by using the reinforcing steel to "squeeze the concrete together", or place it in compression. Compressing the concrete increases it tensile (bending) strength. By increasing the tensile strength of the concrete itself (making the concrete slab or masonry wall stiffer), a designer can achieve longer spans with thinner concrete sections.

Putting the concrete into compression also helps to resist the development of shrinkage cracks. Shrinkage cracks, while typically not detrimental to the performance of the structure, can be unsightly, and can allow the passage of moisture or termites. Shrinkage cracks will develop in most cement based products as the water combines with the cement and the concrete cures (hardens). The more the concrete is "squeezed together", the less likely it is that shrinkage cracks will develop or open.

WHAT KIND OF MATERIALS ARE USED IN POST-TENSIONING

Post-Tensioned reinforcing consists of very high strength steel strands or bars. Typically, strands are used in horizontal applications like foundations, slabs, beams, and bridges; and bars are used in vertical applications like walls and columns. A typical steel strand used for post-tensioning has a tensile strength of 270,000 pounds per square inch. In comparison, a typical non-prestressed piece of reinforcing (rebar) has a tensile strength of 60,000 psi . Strands typically have a diameter of ½ in., and are stressed to a force of 33,000 pounds using a hydraulic jack.

The prestressing steel is housed in a sheathing or duct to allow it move as the tensioning force is applied after the concrete cures. The steel stretches as it is tensioned, and it is locked into place using an anchoring component that forms a mechanical connection and keeps the force in the strand for the life of the structure.

USES AND ADVANTAGES

Post-Tensioned reinforcing has been used for many decades in bridges, elevated slabs (parking garages and residential or commercial buildings), residential foundations, walls, and columns. The use of post-tensioned reinforcing can result in thinner concrete sections, longer spans between supports, stiffer walls to resist lateral loads, and stiffer foundations to resist the effects of shrinking and swelling soils. The additional advantage of putting the concrete into compression can be used to construct slabs and walls that have fewer visible cracks that can allow the passage of moisture and termites.

HOW DO I GET MORE INFORMATION

More information can be obtained by contacting a post-tension material supplier located in your area. Always make sure to utilize a material supplier who has a PTI Certified Plant.

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